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From the above measures, adopting a formula supplied by the Astronomer Royal, Mr. Main finds the ellipticity, or $\frac{a-b}{a}$ (a and b being the observed equatoreal and polar diameters) = 0·10925 with probable error 0·00081; or ellipticity $= \frac{1}{9\cdot153}$.

Mr. Main then reduces his measures of the inclined diameters to what they would have been if the two sets had been measured respectively at exactly 45° to the direction of the axis of the ring given in the *Nautical Almanac*, and finds that they are then perfectly equal. As a further proof of the perfect ellipticity of *Saturn*, Mr. Main shews that the mean of the polar and equatoreal measures is equal to the mean of the inclined measures, which should be the case, as far as the second powers of the eccentricity.

The final value of the arc subtended by the equatoreal diameter of *Saturn*, when the log. distance = 0·95, is 18″·73, and that subtended by the polar diameter at the same distance is 16″·68.*

Some Remarks on the Method of the Astronomer Royal for ascertaining the Difference between the true and spurious Disc of Venus.

By Mr. Sheepshanks.

"Having understood from Mr. Adams, that he wanted some good measures of the diameter of *Venus*, I wrote to Mr. Hartnup, requesting him to apply his equatoreal to that planet. In three or four days I received the following answer:—

'*Wire Micrometer*, Means of 10 Measures.

	d h m	Diameter	Power
Feb. 27	6 31,	= 24″·66,	400
28	5 11,	,, = 24·69,	,, 180

'*Double Image Micrometer*, Means of 5 Double Measures.

	d h m	Diameter	Power
Feb. 27	6 56,	= 23″·38,	161
28	5 40,	,, = 23·62,	,,

"'I cannot,' continues Mr. Hartnup, 'at present account for the difference between the wire-micrometer and the divided eyepiece, can you suggest anything which I can do to find it out?'

"On thinking the matter over, I hit upon a plan which I shall shortly explain; but I learned from the Astronomer Royal, that he had used the same method eleven years ago for correcting the disc of *Venus*, and had fully developed it in the volume of Greenwich Observations for 1838, page lii.

"I have still thought the subject worth bringing before the Society; first, because the Greenwich Observations are not read as carefully or as extensively as they ought to be (witness my own

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* Hence at distance 1, Equatoreal Semidiameter = 83″·46
Polar .... = 74·34

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ignorance and that of Mr. Hartnup); and secondly, because the Astronomer Royal has only insisted upon that use of the principle which his own observations required. *Venus* may now be observed very easily; and if the following remarks are just, measures of *Venus* may be employed to give a careful observer much insight into the defects of his telescope, as well as into his own personal qualities and errors.

"It is well known that a bright object, viewed even by the best telescope, appears under an angle somewhat larger than it ought to do; which increase differs, probably, according to various circumstances. A bright image on the retina seems to extend its influence beyond its immediate locality. This is, if I mistake not, generally called irradiation. Again, from the principles of the undulatory theory, the image of a bright point is always of some extent, and is all the larger, the smaller the aperture of the object-glass or mirror in respect to its focal length. Lastly, any defect, such as spherical aberration (which is usually largest in large apertures and short foci), tends to increase the image. It is, therefore, somewhat puzzling to say what the *true* subtended angle in any case is, and difficult to reconcile the statements of different astronomers with different telescopes and under differing conditions. Passing by irradiation for the moment, let us first see how a spurious disc from the other causes mentioned may be reduced to the true disc by the method suggested by the Astronomer Royal.

"Make careful measures of the diameter of *Venus* (with a wire-micrometer or a double-image micrometer), when she is nearest the earth, and also when she is most distant. These measures are best made in daylight, as there is then little or no irradiation, and the limb is seen most steadily. It is easy to get two sets of observations in which the respective distances of *Venus* and the earth are as 1 : 4; and it is evident that the errors from the undulatory theory, a defective object-glass, &c., will alter the apparent disc of the planet by the *same* angular amount, whether the planet be seen under a large or a small angle. Let the true diameter of *Venus* at distance $1 = \theta$, and let the observed diameters at distances d, d', &c. be φ, φ', &c.; also let the spurious increase be e, either from the causes above mentioned, or an erroneous habit of making the measure.

Then

$$\frac{\theta}{d} + e = \varphi, \qquad \frac{\theta}{d'} + e = \varphi'$$

in which θ and e are the only unknown quantities: these are found very accurately, when d and d' differ very much. (The effect of a bad habit of measuring with the wire-micrometer, or in forming the contacts with a divided eyepiece, is got rid of by the above process, that is to say, it is lumped with the spurious disc.)

"To ascertain the effect of irradiation, measure the planet in the daytime, and at night when brightest. The difference in these measures is due, probably, to irradiation. Measure again, throwing in all the light you can, and using as dark a glass as will allow

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satisfactory vision. It will soon be seen to what extent irradiation increases the apparent diameter. What is left of irradiation in daylight, may be eliminated when the law is determined which connects the phenomenon of irradiation with intrinsic brightness and the effect of additional light on the retina.

"If measures of *Venus* point out any defect in a telescope and the law of that defect, the rule so obtained will apply to all other measures of the moon, planets, &c., by the same person with the same telescope. And if such an inquiry does not lead to consistent results, it would seem to follow that there are in telescopes errors other than we have been accustomed to suspect, and obeying different laws.

"The great intrinsic brightness of *Venus* and her manageable diameter make her far fitter for experiments on irradiation than the sun or moon, which can only be compassed by a heliometer."

Observations of Solar Spots at Mr. Lawson's Observatory, Bath.

By Mr. E. J. Lowe.[*]

"As the solar disc during the last few days has exhibited some remarkable phenomena, I send an abbreviated account made with the 11-foot refractor; several powers were used, but 55 was the usual one.

"The spots are distinguished as B, C, and A, and their relation to the centre of the sun is expressed by co-ordinates through his centre, *a* above, *b* below, *r* right, *l* left. When a spot is near the edge it is more convenient to refer it to the edge, and the word *edge* means that the spot is as far from the edge as the figures denote. The direction refers to the sun as seen in an inverting telescope. The figures and fractions are in digits and fractions of a digit.

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[*] In reply to some inquiries, Mr. Lowe informed the Editor that observations of solar spots at the Bath Observatory are made thus :—A reticule of small squares is used as a micrometer, each interval being, very nearly, half a digit, or $\frac{1}{24}$ of the sun's diameter. These spaces, which are about 80″, are, in the language of the Bath Observatory, each called 7°, *i. e.* supposing the sun's diameter about 180°. The mode of registering the observations is very simple and neat. For every observation there is an engraving, in which the reticule wires are represented and numbered, so that when the sun is brought into its proper place in the telescope, each spot is referred at once to its own square in the drawing. For details, a larger system of squares is engraved below the reticule; in these the remarkable spots are carefully drawn, and referred to their proper places by letters. Mr. Lawson's telescope has 7 inches aperture (a very fine glass by Dollond), and is equatoreally mounted, with clock-work. The position of the spots is noted with a power of 55 applied to *Lawson's Solar Eyepiece*, which takes in the whole image of the sun; the details are completed with other powers. There is, besides, a 5-foot telescope on a stand, with a vertical and horizontal motion. Mr. Lawson has sent 10 drawings on days referred to in this paper.